

# **CLASS I BASE COURSE - Section 301**

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Class I Base Courses will be placed on a subgrade layer built in accordance with Specification Section 305. This design feature is the primary difference between Class I and Class II Base Courses. Class I Base Courses that are stabilized with cement must always be produced in a central mix plant. Unless otherwise specified, the contractor may elect to use any of the types of Class I Base Course listed in Specification Section 301; however, the same type must be used throughout the project, unless a plan change is submitted and approved by the DOTD Chief Engineer. The plan change will stipulate the type of Class I Base Course to be allowed in each location of the project.

In locations where normal construction practices for Class I Base Course are seriously impeded, the department may allow the contractor to use Portland cement concrete conforming to Section 901 in lieu of the Class I Base Course type selected for the project. The district construction office will coordinate the decision to allow the use of Portland cement concrete and the determination of the areas in which it is to be allowed. Such concrete construction shall be performed in accordance with the Specification Section 706.

## **MATERIALS**

Specification Section 301 prohibits the blending of individual soils which do not meet specification requirements with other soils meeting specification requirements even if the resulting combination will meet specification requirements. (For example, for materials to be cement stabilized, a soil with a P.I. of 20 shall not be blended with an A-4 classified material, even if the resulting blend meets specifications. The blending is prohibited because soil with a P.I. of 20 does not meet specifications for Class I Base Course and uniform blending cannot be guaranteed.)

**ASPHALTIC CONCRETE AND PORTLAND CEMENT CONCRETE** The materials selected and used for asphaltic concrete and Portland cement concrete must conform to Specification Part V or Part IX, respectively. Sampling, testing, approval or other procedures shall be in accordance with the appropriate *Quality Assurance* manual.

## **TREATED LAYER UNDER ASPHALTIC CONCRETE**

A layer of soil treated with either Portland or Portland-pozzolan cement must be placed under asphaltic concrete constructed as Class 1 base course. The details covering this material will be found in this manual under **Subgrade Layer-Section 305**.

## AGGREGATES TO BE USED WITHOUT STABILIZATION

Stone, slag, and recycled Portland cement concrete may be used for Class I Base Course without stabilization. These materials must meet all specification requirements and be sampled, tested and approved from dedicated stockpiles prior to placement on the subgrade. For regulations for dedicated stockpiles, refer to page ? and the *Materials Sampling Manual*.

## MATERIALS TO BE USED WITH STABILIZATION

Sand clay gravel, sand-shell, and soils will be stabilized with Portland or Portland-pozzolan cement for Class I Base Course. It shall be the responsibility of the contractor to locate and select materials which meet the specifications and which are appropriate for use in the central mix plant to be used on the project. It may not be possible to use all materials that are approved for use in Class I Base Course in all central mix plants. The contractor shall determine which materials can be uniformly fed and mixed by the plant. To ensure uniformity of materials and the validity of cement percentages and test results, the selection, storage, and handling of materials to be stabilized for Class I Base Course will be in accordance with **STORAGE AND HANDLING OF MATERIALS**. **DOTD plant certification and approval of materials for use in no way guarantees their success on the project. Such approvals only mean that the contractor may use the equipment and materials. It remains the contractor's responsibility to ensure the materials when processed meet specification requirements.** Soils for Class I Base Course are to be naturally occurring and undisturbed. In-place soils, which have been disturbed and may have been treated or otherwise modified, are not approved for Class I Base Course. The following chart summarizes the specification requirements for soils to be used as soil cement.

| CHARACTERISTIC           | TEST   | SPECIFICATION                        |
|--------------------------|--------|--------------------------------------|
| Classification           | TR 423 | A-1-a, A-1-b, A-2-4, A-2-6, A-4, A-6 |
| Liquid Limit             | TR 428 | 35 or less                           |
| Plasticity Index         | TR 428 | 12 or less                           |
| Organic Content          | TR 413 | 2% or less                           |
| Sand Content             | TR 407 | 79% or less                          |
| Silt Content             | TR 407 | 60% or less                          |
| Topsoil*                 |        | Prohibited                           |
| Stabilization (% Cement) | TR 432 | Must Stabilize                       |

Failure to meet any one of the above criteria will result in the disapproval of the material for use in stabilized base course.

### MATERIALS SPECIFICATION REQUIREMENTS FOR SOIL CEMENT



\* Topsoil: Topsoil is the top layer of a layered soil profile, which is present when soils are found in their original position. These soils are normally darker in color due to their higher organic content, resulting from the breakdown of vegetative residue. This zone supports the roots of grasses and small shrubs and is highly leached. The leaching process by rainwater results in a soil which contains the most weather resistant materials, usually sand and silt particles composed of silica. Also due to the leaching process, many topsoils have particles of similar size creating a poorly graded material. This poor gradation, in conjunction with higher organic contents and chemical characteristics that cause the soil to be unsuitable for chemical treatment or stabilization, results in an inferior construction material. Topsoils that have been removed from their original position, even for long periods, do not lose the characteristics that make them unsuitable for chemical stabilization. Spoil areas are typical examples of topsoil materials which are unsatisfactory for certain construction uses. Blending topsoil with other materials also does not yield a satisfactory material, especially for chemical stabilization.

## **DESIGN**

Soil or soil-aggregates to be incorporated into a Class I Base Course will require a design based on either gradation or strength. The cement factors for sand-shell and sand clay gravel are specified; therefore, compressive strength testing is not necessary. Sand-shell shall be approved in individual component stockpiles before blending at the 35% sand, 65% shell ratio. Sand clay gravel shall be composited to ensure that the resulting blend of individual components meets the specification requirements for the base course material. It shall be the responsibility of the contractor to determine the gradation of the composited material and to submit it to the district laboratory engineer for approval. The contractor shall contact the district laboratory engineer if there are any questions regarding the proper materials or the appropriate percent cement. This design shall be submitted to the district laboratory on the *Base Course Design for Central Plant Materials Mixtures* (DOTD Form No. 03-22-0752). Refer to page A-15.

When cement is to be added to soil or soil-aggregates and the percent cement is not included in the contract specifications, materials will be subjected to procedures to determine minimum design strength. When a method other than DOTD TR 432 - Method A is used to determine the percent cement needed to stabilize a soil, the department may require the maximum time allowed by specifications to perform the test. Method A will require at least five days. When soils are to be stabilized with cement, the district laboratory engineer will determine which method of test is appropriate. The department will perform all cement design. It shall be the responsibility of the contractor to build the dedicated stockpile and request approval far enough in advance of planned construction operations to allow for this testing and design. The contractor shall provide stockpiles of actual materials that are to be tested for stabilization.

The cement factor to be used for soil stabilization will be determined by the department and will be based on strength. It is the responsibility of the contractor to advise the district laboratory engineer and the project engineer of the type of cement to be used for stabilization (Type I, IB, II, or IP). The district laboratory will use the same type of cement to determine the cement factor. If the contractor does not inform the district laboratory of the type of cement to be used, the cement factor will be determined using Type IB. The contractor will then be required to use Type I or IB for stabilization. If the

contractor does not use Type 1 or 1B, operations will be delayed until the district laboratory can determine a new cement factor.

When any type other than I or IB cement is used for soil stabilization, the department will not use DOTD TR 432 - Method A to determine the cement factor.

**DOTD TR 432 - METHOD A will be used to determine the percent cement only when soils to be stabilized are naturally occurring, previously undisturbed in a borrow pit, and are materials with a history of not having stabilization problems.**

## **STORAGE AND HANDLING OF MATERIALS**

**STOCKPILES** The contractor shall place all soils and aggregates used in Class I Base Course in dedicated stockpiles. For regulations for dedicated stockpiles, refer to page 10. No segregation or significant variance in moisture content shall occur during the building of the stockpile and subsequent handling of the material. Individual materials shall be kept in separate stockpiles. The removal of material is not to cause contamination, nonuniform gradation or any other change in the quality of the stockpile.

Materials to be placed in a single stockpile shall be uniform in terms of classification, Atterberg limits, moisture content, moisture-density relationships, gradation, feedability (flow), stabilization, and compaction characteristics.

The moisture content in the stockpile must be coordinated with the optimum moisture content of the material to ensure that at the time of compaction all material will be within the specification tolerance for optimum moisture content. It is not acceptable to attempt to dry excessively wet material during blending, hauling or placement on the project.

Soils in a single stockpile must exhibit close moisture-density relationships. If the moisture-density relationships of materials vary, the compaction effort being used for one material will not yield the same density on the other material. It is critical to the uniformity of compaction that once an effective compaction procedure is established, continual adjustment due to changing material conditions not be necessary. Such need for procedural modification will subject the contractor to an increased risk of payment adjustment or the discontinuance of operations until the contractor can demonstrate a uniform compactive effort and material blend that will yield density meeting the specification requirements for 100% payment.

**When materials are to be cement stabilized, it is mandatory that all materials in a single stockpile stabilize with the same percentage of cement.** When multiple stockpiles are used to produce a mixture to be cement stabilized, material in the individual stockpiles shall be uniform and the resulting blend shall stabilize with a single percentage of cement.

## **CEMENT**

The contractor shall protect cement at a central mix plant to prevent the intrusion of dampness, water or other contaminants. Cement that has partially set or has visible signs of moisture damage shall not be used. Seals from transports shall be checked to

ensure that they match the numbers on the Cement Certificates of Delivery. If the seal number does not match the Cement Certificate of Delivery, the transport of cement is not to be accepted.

## **WATER**

Water shall be from approved sources and shall not be contaminated during storage or handling.

## **EQUIPMENT**

All equipment for the production, transport, placement, compaction, and finishing of Class I Base Course materials shall be approved prior to use. Project personnel will inspect equipment daily prior to use. Equipment shall be in good working condition and shall not leak fluids onto the grade or roadway. Equipment initially approved for use shall continue to conform to the standards upon which this approval is based. When approved equipment fails to meet these requirements, it shall be removed from the project until repairs are made and approval reinstated.

## **ASPHALTIC CONCRETE AND PORTLAND CEMENT CONCRETE**

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## **ASPHALTIC CONCRETE AND PORTLAND CEMENT CONCRETE**

For equipment inspection, certification, and approval processes for asphaltic concrete (501 or 502) and Portland cement concrete (706 or 901) refer to the appropriate *Quality Assurance* manual.

### **PRODUCTION EQUIPMENT**

All plants used to produce Class I Base Course shall be certified. For certification requirements and procedures for Central Mix Plants, refer to page 16.

### **TRANSPORT EQUIPMENT**

#### **RAW BASE COURSE**

Trucks used to transport raw Class I Base Course are to be inspected prior to use and daily by project personnel. Trucks that haul material over state or federal roadways shall be weight certified. Trucks shall be capable of hauling material without loss of material, excessive drying, or segregation. If necessary, covers may be required to prevent nonuniform moisture contents or loss of fines. Beds shall be smooth metal, clean, with no holes. Extensions shall meet the requirements of EDSM III. 5.1.3. Covers shall be large enough to completely cover the mixture and extend over the sides and ends of the bed, be in good condition with no tears or holes, and be equipped with adequate tie-downs. Covers are to be large enough to prevent excessive air circulation or the intrusion of rain.

#### **STABILIZED BASE COURSE**

Trucks used to transport cement stabilized Class I Base Course from the central mix plant to the project site shall meet all requirements listed for trucks used to transport raw Class I Base Course. Covers shall be kept in place until the material is actually placed to protect the material from excessive loss of moisture.

### **PLACEMENT AND SPREADING EQUIPMENT**

Class I Base Course shall be placed and spread without segregation and in uniform thickness and fluff to allow for uniform compaction and finish to plan dimensions, cross slope and grade. The equipment shall leave the material at a uniform moisture content, without excessive drying.

Class I Base Course may be spread with a base course spreader or other approved equipment. The equipment shall be operated to leave the surface slightly above grade so that finish grade, cross slope, thickness, and width requirements are met after finishing.

### **COMPACTION EQUIPMENT**

Rollers for Class I Base Course may be either self-propelled or tractor powered. When vibratory compactive effort is permitted, the rollers shall be capable of independently controlling amplitude and frequency.

### **RAW BASE COURSE**

Stone, recycled Portland cement concrete, and crushed slag shall be compacted with equipment designed for the compaction of each specific material. The compaction equipment may be either static or vibratory. The department reserves the right to require only static compaction equipment when the engineer determines that vibratory compaction may damage the base course or underlying or adjacent materials. (Examples of indications of damage to the base or underlying layers are loss of density, cracking, movement, free water, perched water tables, breaking down compaction in underlying layers due to silty or sandy characteristics, etc.)

The compacted material shall be finished with pneumatic tire rollers or static, smooth, steel-wheeled rollers as required by the specifications.

### **STABILIZED BASE COURSE**

Stabilized base course shall be initially compacted with a conventional sheepsfoot roller or a self-propelled tamping foot compactor-type roller. The spikes shall be sufficient in size and number to provide uniform compaction for the full width and depth of the base course. **Compaction equipment with waffle-type or similarly styled drums, smooth wheel vibratory rollers, steel wheel, or pneumatic rollers will not be permitted for compaction.** Such equipment will cause lamination and nonuniform compaction, even though the average density may meet specifications. The nonuniform density caused by this equipment will lead to premature failure due to the lack of adequate density in the bottom of the base course.

The compacted material shall be finished with pneumatic tire rollers except that a smooth steel wheeled roller shall be used for sand shell bases. The pneumatic roller shall have an odd number of tires, arranged so that the spaces between one row of tires are covered by the tires of the other row. All tires shall be in place and shall be in good condition and properly inflated. Tires shall be smooth tread, of the same size and ply, and inflated to within  $\pm 5$  psi of each other.

### **FINISHING EQUIPMENT**

Class I Base Course shall be finished with an approved automatic finishing machine. The approved automatic finishing machine shall be capable of being operated from an erected stringline, and capable of automatically controlling grade and cross slope meeting the requirements of Specification Subsection 501.07(b)(2) or 502.07(b)(2). The stringline shall be set to produce a uniform grade and cross slope, meeting the specification acceptance requirements. The stringline shall be supported adequately to ensure that there are no dips or humps between supports. The stringline shall be erected by the contractor and will be inspected by project personnel. It shall be kept clean and taut. The finishing machine shall leave a smooth surface at proper, uniform grade and cross slope. The finishing machine shall leave no loose material on the surface. The automatic finishing machine shall cut the material across the full width of the roadway without damaging the surface. **Cold planers will not be approved.**

## **WATER TRUCKS**

Water trucks are to be equipped with spray bars which uniformly spray water across the surface and do not apply water in streams or cause water to puddle on the surface. Water trucks shall be weight certified and shall not be loaded in excess of the permitted load limit.

## **ASPHALT DISTRIBUTOR**

When prime coat is being applied, the asphalt distributor shall conform to Specification Subsection 503.07, as required by Specification Section 505. Asphalt distributors used to spray prime coat over the completed base shall be equipped with a spray bar which uniformly sprays the prime coat across the surface and does not apply the prime coat in streams or cause it to puddle on the surface. Clogged nozzles will not be allowed. Asphalt distributors shall be weight certified and shall not be loaded in excess of the permitted load limit.

Equipment used to distribute asphaltic curing membrane shall conform to Specification Section 506. Asphalt distributors spraying asphaltic curing membrane must be equipped for easy determination of the rate of application.

## **CONSTRUCTION DETAILS**

Construction details, both plant and roadway, for asphaltic concrete and Portland cement concrete must meet the requirements of the appropriate Specification Sections, 501, 502, 706, or 901 as outlined in the Quality Assurance Manuals.

## **PLANT OPERATIONS**

The central mix plant and location shall be maintained in a safe, clean condition. The plant shall be equipped with a laboratory conforming to Specification Section 722. The plant shall be located where it will not be necessary for haul trucks to traverse newly placed base course. The district laboratory engineer will approve testing equipment. Scales and metering devices will be calibrated, documentation submitted to the district laboratory engineer, and their calibration approved by the district laboratory engineer prior to production. Calibration shall be by an approved, independent service or by the Weights and Measures Division of the Department of Agriculture and Forestry. Independent calibration services must be licensed by the Department of Agriculture and Forestry.

Testing equipment not available at the plant during the certification inspection will be inspected, calibrated and approved prior to use.

**WEATHER LIMITATIONS** Both contractor and department personnel need to be constantly aware of weather conditions. For all base courses, when inclement weather is predicted, the contractor is to monitor operations to prevent material from being shipped to the jobsite where weather conditions will prohibit its use. If the material

cannot be maintained within the specification range of optimum moisture content due to weather conditions, placement of the material will not be permitted. If the weather causes stockpiles to be too wet to produce material that will meet the specification tolerance for optimum moisture content, production is not to be started. Additionally, the contractor should not produce mixture during borderline weather conditions that may have a detrimental effect on construction operations or materials. When scheduling operations, the contractor and the department's representative are to consider such factors as length of haul, speed of placement, compaction and finishing, current temperature and weather, past weather conditions (e.g., standing water, wet subgrade or stockpiles, excessively dry conditions, etc.), predicted weather changes (e.g., approaching weather fronts, winds, temperature changes, rain, changes in humidity, etc.).

The specifications prohibit the production or placement of Class I Cement Stabilized Base Course when the subgrade or stockpiles are frozen, when the ambient temperature is less than 35°F, the temperature from the nearest weather forecasting station is to be 25°F or less within the 24 hour period following placement, or during rain. This information is also available from the DOTD, Maintenance Engineer. Ambient temperature is determined in the shade, at the jobsite, away from artificial heat. However, it is imperative that operations be scheduled and monitored to ensure that these conditions do not occur during production or placement.

If, despite precautions for inclement weather, rain falls on freshly spread cement or base material mixed with cement prior to the completion of compaction, the inspector will document the affected area. Immediately after completion of compaction, new moisture content tests will be taken after rain to determine if the material is within the ±2% specification tolerance of optimum. After 7 days the area will be cored and tested for percent cement and strength. If the area does not meet design requirements, the area shall be restabilized or retreated in accordance with the specifications at no direct pay.

## **STOCKPILES**

Stockpiles shall be built on a well-drained surface, far enough apart that no intermixing of materials will occur during operations. If the area is not large enough to permit adequate distance between stockpiles, a bulkhead shall be erected between stockpiles to prevent intermixing of materials. The bulkhead shall be of sufficient height and length to prevent intermixing of materials or spillage over the top. The method of removing material from the stockpiles must be approved prior to the beginning of plant operations and will be subject to continual department inspection for satisfactory operation. No contamination or intermixing of materials between stockpiles shall occur during the removal of material from stockpiles. If a dragline is used to remove material from stockpiles, no material is to be dropped onto other stockpiles. The dragline is not to be overfilled.

The specifications require that the cement stabilized or treated mixture on the roadway at the time of compaction be within ±2% of optimum. Therefore, it is critical that the moisture content of material removed from the stockpile not vary significantly. In order to ensure that the mixture on the roadway will be within specifications, once a working face has been established, material is to be removed only from this level. Removing material from above or below the level of the working area will result in widely varying moisture contents, especially after rain. When material is added to a working stockpile

from another approved stockpile, if the moisture content of the added material is not close to that of the working stockpile, material is not to be removed from the added material until the moisture content has stabilized. If the moisture contents of the two stockpiles or of different areas of the same stockpile are significantly different, it will not be possible to blend the materials together and still produce a final mixture within specification tolerance for moisture content.

Stockpiles of recycled Portland cement concrete must be approved at the source. Refer to the *Materials Sampling Manual*, DOTD Designation S:801.

## **FEEDER SYSTEM**

The feeder system of the central mix plant is composed of bins, belts, scales, moisture control mechanism, automatic shut-off device, and any other plant components used to move or temporarily store soils, aggregates, and cement between the stockpiles and the pugmill. Feed rate shall be adjustable. When control is accomplished by gate openings the gates shall be adjustable and lockable. Belt speed shall be adjustable to control plant production rate.

Bins shall be free of holes, shall not allow material to bridge or collect in corners, and shall not allow material to intermix at the top or during loading. If vibrators do not effectively result in an even flow of material through the bin, other methods shall be used to achieve satisfactory results. Material will not flow through a bin if it is too wet; in this situation, it will be necessary to allow time for the stockpile to reach a lower, uniform moisture content.

Belts shall be free of sags, tears, or holes. They shall move smoothly and carry material from bins to the pugmill without spillage.

The moisture control mechanism will consist of the spray bar and metering or weighing system. It shall be capable of adjusting the flow rate and of being locked into position. The spray bar shall apply water uniformly across the full width of material. Blocked nozzles shall be cleaned immediately. When nozzles become blocked, operations will be stopped immediately until they are cleared. Lines shall not leak water.

An operational variation of 1% by weight in cement is allowed. The tolerance of 1% by weight is only intended to compensate for normal variations in plant operation. For aggregates and soils, the specifications allow an operational variation of 2% of the individual weight of each component; however, the total weight of the aggregate and soils shall be within 1% of the required weight of the total material.

## MIXING SYSTEM

The Central Mix Plant mixing system shall be adequate to handle the production rate on the *Base Course Design for Central Plant Materials Mixtures*. It shall provide a uniformly blended material, showing no segregation. All paddles shall be in place and within the manufacturer's requirements for wear. The mixing chamber shall be equipped with a spray bar to provide uniform water spray to the material during mixing with volume and spray pattern adjusted to ensure that the material will be uniformly at the proper moisture content during compaction. Gates shall lock and not leak during mixing. To regulate the mixing time, the mixing system in a batch type plant shall be equipped with an automatic timing device that counts in seconds and is interlocked with the mixing system of the pugmill. For continuous type plants, to ensure a uniform blend, the feeder system shall be coordinated with the pugmill to match the feed rate to the mixing rate. The mixing rate is the speed at which the pugmill can uniformly mix and discharge the materials. The mixing system shall be arranged to discharge the material completely; no build-up shall occur in the mixing chamber. Material shall be discharged directly into haul trucks.

| MATERIAL  | MEASURING DEVICE ACCURACY | FEED TOLERANCE |
|---|---------------------------|----------------|
| Soil/Soil-Aggregate   | 0.05% (wt)                | 2% (wt)        |
| Cement  | 0.05% (wt)                | 1% (wt)***     |
| Water   | 1% (vol)<br>0.5% (wt)     | **             |
| Liquid Additive   | 3% (wt)                   | 3%             |
| *Individual aggregates and soils within 2% of individual weight.<br>Total weight of aggregate within 1% of total material weight.<br>**Must be accurate enough to ensure $\pm$ 2% of optimum at time of compaction.<br>***Tolerance for payment adjustment in accordance with Table 301-4 is not affected by this feed tolerance. |                           |                |

### CALIBRATION AND FEED TOLERANCES

#### NOTE

Exceeding the feed tolerances will cause the inspector to require the contractor to discontinue operations. Varying within the limits of the feed tolerances can result in payment adjustments.

## **TRANSPORT**

Stabilized, treated or raw material in transport shall be protected en route from loss of fines or moisture, contamination, and segregation. Cement stabilized or treated materials shall arrive at the project quickly enough for placement and compaction to be completed within the time frame established by the specifications.

## **PLANT LOT**

A basic plant lot for central mix plant operation consists of a day's production of an individual plant from one mix design. When an acceptance test indicates that a payment adjustment for percent cement is required, the lot shall be terminated. A new lot number will be assigned for the material produced following adjustments by the contractor that result in a QC test showing successful correction. If a plant discontinues the day's operations before an acceptance test has been performed, acceptability and percent pay will be determined based on investigation of QC tests, knowledge of the plant's condition and performance, and other department tests necessary to evaluate the material (e.g., cement content, compressive strength). The department may unilaterally terminate a lot when inspection procedures, QC or acceptance tests indicate loss of control of the product or operation that may cause nonspecification material to be delivered to the project.

# **QUALITY ASSURANCE REQUIREMENTS**

## **QUALITY CONTROL (QC)**

### **Raw Base Course**

For raw bases, the contractor is responsible for establishing a QC program that is approved by the project engineer. The contractor shall follow the approved plan. If failing results occur during LA DOTD testing, the contractor will be required to modify the QC program to ensure that failing results do not continue.

### **Treated Layer Under Asphaltic Concrete**

Quality control operations must meet the requirements of Specification Section 305.

### **Cement Stabilized Base Courses**

The contractor shall perform tests as needed to ensure that the plant continually operates within specifications. When separate materials are being blended to meet specification gradation, the contractor shall perform gradation testing on the composited material. Gradation testing shall be performed **at least twice each day** in accordance with DOTD TR 112 and DOTD TR 113. The results of each gradation test shall be documented. When gradation testing shows that there is a tendency for the composited material to move toward the outside limits of the gradation tolerances approved on the *Base Course Design for Central Plant Materials Mixtures*, the contractor shall make

corrections immediately to prevent the gradation from deviating from the approved design.

The contractor shall perform tests for moisture content in accordance with DOTD TR 403. Tests shall be performed on material in stockpiles and on the blended material discharged from the pugmill. Tests shall be performed at the beginning of each day's operation and at least twice more each day on both stockpile material and blended material. Tests for moisture content shall also be performed whenever the plant resumes operations after a period of discontinued operation or when the contractor or engineer believes a change has occurred in operations or materials. The moisture content of the stockpile material will determine the quantity of water to be added to the material as it is processed; the moisture content of the material discharged from the pugmill will determine if the correct quantity of water has been added to ensure that the Class I Base Course will be within  $\pm 2\%$  of optimum at the time of compaction. When the moisture content of the material being processed varies or when the Class I Base Course is not within  $\pm 2\%$  of optimum during compaction, **the contractor shall perform as many moisture content tests as necessary to produce a material that meets specifications.** When the contractor is not able to control moisture content to within  $\pm 2\%$  of optimum at compaction, the contractor shall discontinue operations.

The contractor shall check the percent cement being incorporated into the mixture at the beginning of each day's operation and at least four additional times each day. Tests for percent cement (TR 436) shall also be performed whenever the plant resumes operations after a period of discontinued operation. Cement shall be diverted for a specific time period, weighed, and compared to the required percent cement. Cement shall be diverted from the silo before it is placed on the belt. The testing of cement and the results of the tests shall be documented. Material produced during calibration or design shall not be sent to the project. Additionally, the contractor shall continually monitor the proportioning of the other individual components of the base course mixture. This shall include monitoring flow rates and weighing the material to check the calibration of the feeder system as often as necessary to ensure continuous production of the mixture approved on the *Base Course Design for Central Plant Materials Mixtures*. When materials are diverted, weighed and compared to the required percent cement, the tests shall be documented. When flow rate is interrupted, the calibration of the feeder system is altered, or the percentage of cement being incorporated varies from that approved on the *Base Course Design for Central Plant Materials Mixtures*, the contractor shall immediately discontinue plant operations. Corrections shall be completed, material produced conforming to the mixture approved on the *Base Course Design for Central Plant Materials Mixtures*, and the recommencement of operations approved by the engineer before additional material is delivered to the project.

It is the department's intention that the design percent cement be incorporated into the material. Although there is no payment adjustment for material with cement in excess of the design percent, such material with cement quantities more than 1% over required percent is not to be sent to the project site. The values for optimum moisture content will not be valid for extra cement; therefore, compaction problems may develop. If the contractor elects to add more cement than the design percent, additional testing must be performed to determine the optimum moisture content. **The additional cement shall not exceed 1% by weight; however, up to 1% more than design percent is acceptable.**

The contractor shall check the percent pulverization of the blended material discharged from the pugmill at least twice daily. The percent pulverization shall be performed in accordance with DOTD TR 431. The test results for pulverization shall be documented. When pulverization testing shows that there is a tendency for the composited material to move toward the outside limits of the specifications, the contractor shall make corrections immediately to prevent the mixture from deviating from the specifications. The contractor shall set the plant controls at a production rate that will maintain a continuous operation. Because of the two-hour time limit for the completion of soil cement placement and compaction, **stop and go operations will not be allowed.** Plant operations shall be discontinued early enough in the day to allow the completion of final finish and application of the curing membrane at the end of the day's operations.

## **INSPECTION AND ACCEPTANCE**

When central mix plant operations are used, DOTD construction personnel will inspect plant operations and the material for continual conformance to specifications. **Inspectors are to observe the operation of plant equipment and visually inspect the material.** Changes in production or the appearance of any individual component or the blended material are to be promptly investigated. Deficiencies in equipment are to be reported to the contractor and immediate repair required. Inspectors will perform tests on the blended material from the pugmill for gradation and pulverization and will check the percent cement and proportioning of materials. Test procedures used by the department will be the same as those to be used by the contractor for QC testing (Gradation for aggregates - DOTD TR 112 and DOTD TR 113, Pulverization - DOTD TR 431, Moisture Content - DOTD TR 403, Percent Cement - DOTD TR 436).

Acceptance tests for gradation will be performed whenever a gradation requirement is applicable. Tests will be performed whenever the gradation is questionable or whenever sand clay gravel or sand-shell is being blended from individual components. Gradation tests are to be performed at least once each day. When department tests show that the gradation deviates from specification tolerance, the contractor will be required to make immediate adjustments or discontinue operations.

Acceptance tests for pulverization will be performed at least twice per day. The results of these tests will be used to ensure that material that does not meet pulverization specifications will not be delivered to the roadway. When department tests show that the pulverization deviates from specification tolerances, the contractor will be required to make immediate adjustments or discontinue operations.

Acceptance tests for percent cement will be performed at least twice per day. The results of each test will represent the material delivered to the project since the previous acceptance test or beginning of the current day's operation. When department tests show that the percent cement varies from that approved for 100% payment, the contractor will be required to make immediate adjustments or discontinue operations.

Acceptance tests for proportioning of other individual components will be performed at least twice per day. The results of these tests will be used to ensure that material that does not meet the proportions approved on the *Base Course Design for Central Plant Materials Mixtures* will not be delivered to the roadway. When department tests show that the proportioning of components varies from that approved, the contractor will be required to make immediate adjustments or discontinue operations.

# **ROADWAY OPERATIONS**

## **PLACEMENT AND SPREADING**

Material shall be placed on the subgrade layer, constructed in accordance with Specification Section 305, and spread across the roadway and longitudinally up and down station to uniform thickness, without segregation, excessive moisture loss, or subgrade damage. **The addition of water during placement or spreading is prohibited.** Haul trucks shall not be allowed to travel across freshly placed or spread material. Therefore, the placing and spreading operation shall be planned and arranged so that this prohibition will not become a problem.

## **JOINT CONSTRUCTION**

On soil cement base courses, transverse joints shall be formed by cutting back into the previous day's completed base course to sound material forming a vertical face for the total width and depth of the base course. The base course at the joint shall conform to the typical section shown on the plans. Fresh material from present construction shall be placed and uniformly compacted against the vertical joint face. All loose or broken material shall be removed from the joint area. Care is to be exercised to prevent joint areas from premature failure. Premature failure is a special problem at joints because they form a weakened plane in the base.

Transverse joint construction for bases composed of untreated or unstabilized materials shall be as directed by the engineer.

Class I Base Course shall be constructed for the full width of the roadway without longitudinal joints, unless specified or approved by the project engineer. When the construction of a longitudinal joint is approved, the joint area shall be trimmed to a vertical surface after compaction, but prior to final set. The longitudinal joint shall consist of sound, stable material, meeting specification requirements for base course density.

## **COMPACTION**

### **Cement Stabilized Bases**

For cement stabilized bases, initial compaction shall be performed with a conventional sheepsfoot roller or a self-propelled tamping foot compactor type roller. The weight of the roller shall be adequate to achieve penetration for the full depth of the base course on the first pass and to achieve specification requirements for density. If bridging occurs or full depth compaction is not achieved, the contractor shall immediately adjust the operation or replace the equipment.

After initial compaction and rough shaping, it will be permissible to apply water uniformly to the surface if necessary to prevent surface drying. The addition of water will require the approval of the engineer. If the application of water to the surface is allowed, it shall be done with a manifold system that uniformly spreads the water across the path of the water truck. **The addition of water to modify the moisture content of the base course will not be permitted. Optimum moisture must be controlled at the pugmill.**

Final compaction will be performed with a static pneumatic roller, except that a smooth steel wheel roller shall be used on stabilized sand shell. The surface shall be left in a reasonably smooth condition with no laminations, corrugations, dips or bumps. The compaction equipment shall leave the surface of the base course sufficiently above grade for the finishing equipment to achieve a proper, uniform grade and cross slope.

All compaction must be completed within the specified time limit or the base is unacceptable and construction processes will immediately be modified.

### **Treated Layer Under Asphaltic Concrete**

Compaction shall meet the requirements of Section 305.

### **Raw Aggregate Base**

Compaction requirements are the same as those for stabilized bases except that no time limit will apply. A vibratory roller may be used with approval when it is not detrimental to any portion of the roadway.

## **FINISHING**

### **Cement Stabilized Base**

When the final finish on the compacted Class I Base Course is completed using an automatic finishing machine, it shall be controlled from an erected stringline. The stringline and construction techniques must meet the requirements of **Erected Stringline**, Sections 501 or 502. The planer blades shall be set to establish plan cross slope; the erected stringline shall be set and the wire stretched so that final grade is at plan grade. The final surface shall exhibit no waves, dips, bumps, laminations, or high or low areas. Because curing membrane must be applied the same day as placement and compaction, the final finish must also be completed the same day as placement and compaction.

The specifications require that the manipulation (placement and compaction) of stabilized Class I Base Course be completed within two hours of initial mixing. Only final finishing, moist curing, and the application of asphalt curing membrane will be allowed on soil-cement after two hours. No traffic, including construction equipment (except equipment needed for the application of asphaltic curing membrane), shall be allowed on the base course after two hours. Asphalt distributors used for the application of curing membrane shall not be large enough to damage the partially cured base course. When time allows, low areas may be corrected using fresh material thoroughly blended with the in-place material by an approved in-place mixer meeting the requirements of Specification Subsection 303.03, compacted and refinished. Any corrected area will need to meet the same specifications as an area which did not require correction during operations. Laminated areas or areas exhibiting waves, dips, or other deficiencies which cannot be corrected with the automatic finishing machine will be removed and replaced with fresh material in the same manner as low areas. Bumps and high areas may be corrected with the automatic finishing machine.

**No manipulation of the stabilized Class I Base Course will be permitted once two hours have elapsed from initial mixing.** When time does not allow correction before or during finishing, correction shall be made after the curing period and shall be by an approved method conforming to the requirements Specification Subsection 301.16.

All corrections will require the approval of the engineer. Correction methods that may damage adjacent or surrounding Class I Base Course or other construction will not be permitted. Areas in which an attempt is made to correct a deficiency, but for which correction cannot be completed prior to the two-hour specification time limit, shall be reconstructed in accordance with Specification Subsection 301.16.

### **Raw Aggregate Base**

Compaction requirements are the same as those for stabilized bases except that no time limit will apply. Water can be added for compaction purposes if excess water does not cause the underlying materials to deteriorate, and prime coat is used rather than curing membrane.

### **Treated Layer Under Asphaltic Concrete**

Compaction shall meet the requirements of Section 305

## **QUALITY ASSURANCE**

### **QUALITY CONTROL (QC)**

#### **Stabilized and Raw Base Course**

The contractor shall observe the placement, spreading, compaction, and finishing operations and perform tests as needed to ensure that the base course meets all specification requirements. **The contractor shall make adjustments to correct deficiencies and maintain the project uniformly within specifications as soon as any deficiency is noticed. The specification time constraints of stabilized Class I Base Course do not allow the contractor the luxury of waiting for the department to direct that corrections be made. Prompt identification and correction of deficiencies will significantly lessen the contractor's risk of payment adjustments or costly reconstruction.**

The material shall be tested for moisture content in accordance with DOTD TR 403 during placement and compaction to ensure that the moisture content is within  $\pm 2\%$  of optimum at compaction. If the moisture content cannot be maintained within this tolerance, the contractor shall notify the plant to adjust the moisture content. If the problem persists, the plant is to be notified to discontinue sending material to the project until the moisture content can be controlled. **Material that does not conform to the specification tolerances for moisture content will not be evaluated for acceptance and shall be removed and replaced.**

The contractor shall check rough grade, thickness, and cross slope during placement, spreading and compaction to ensure that the completed base course will meet specification parameters, including density, after final finishing. Areas which may not meet department standards are to be corrected prior to final finishing.

The contractor is to perform density testing in accordance with DOTD TR 401 during the compaction process. The results of these density tests are to be used to establish rolling patterns, to evaluate the appropriateness of the equipment selected, and to ensure that the finished base course will meet the department's specifications for density.

The contractor shall actively look for nonuniform areas, such as varying thickness, segregation, wet spots, laminations, pumping areas, grade changes, warped cross slopes, excessive dusting, etc. which require correction. Such areas are to be corrected immediately.

### **Treated Layer Under Asphaltic Concrete**

Quality assurance requirements of Section 305 shall be met.

## **INSPECTION AND ACCEPTANCE**

### **Stabilized and Raw Base Course**

Before the contractor begins operations, the project engineer, in conjunction with the district laboratory engineer, will establish 1000-foot sections for QC and acceptance. It is to be noted that bridges and exceptions and equations are not to be included in the continuity of 1,000 feet. All sections are to be approximately 1000 feet in length, with the exception of the first and last sections that may vary between 750 and 1250 feet in length. Section lengths will be measured and reported to the nearest foot and be delineated by station numbers and sketches, as needed. These sections will be used for all acceptance measurements and testing, including density and DOTD TR 602.

It is the responsibility of the department to inspect the project for conformance to specifications and good construction techniques. The department will observe the contractor's quality control program as part of the inspection process. **When deficiencies in the QC program are found, the inspector will require immediate correction or construction operations will be discontinued.** The department will independently inspect the project and perform tests as needed to ensure that the final project meets specifications.

Moisture content of the material being compacted will be checked **at least** twice each day in accordance with DOTD TR 403. Additional testing may be performed if excessive variations in moisture content at placement are noted. If the material is not within the specification tolerance, immediate correction will be required. The contractor will be required to modify the QC program to ensure that additional failing acceptance tests do not occur. Material that is not within the specification tolerance for moisture content at compaction will not be evaluated for acceptance and shall be removed and replaced.

The density of the completed base course will be checked in accordance with DOTD TR 401 once per each 1000 linear feet of roadway and once per each 2000 linear feet of shoulder. The results of these acceptance tests will determine the acceptability of the area represented by the test.

Grade and cross slope of the finished base course will be inspected for acceptance by project personnel. Areas that do not conform to the specifications will be isolated and correction will be required. Project personnel will measure the thickness and width of the base during construction in accordance with DOTD TR 602 and document these measurements in a field book set up for thickness and width measurements. Areas that do not conform to specification tolerances for plan thickness or width are to be isolated longitudinally and corrected for the entire width of the section. To isolate a deficient area, move up and down station five feet and retest. Then, test at 25-foot intervals until the limits of deviation from specification tolerance are identified. The district laboratory will determine thickness and width of the completed base course in accordance with DOTD TR 602 for final acceptance. The district laboratory engineer will notify the project engineer of areas that do not meet specification requirements. The project engineer will require the contractor to correct these areas. Additional thickness and width measurements will be taken by the district laboratory as necessary on the corrected areas prior to final acceptance. If the contractor elects to correct a deficient area by restabilizing, a new design will be required.

Deficiencies identified by visual inspection, such as laminations, dimensional deficiencies, soft areas, etc., shall be corrected before the section will be accepted.

### **Visual Inspection**

It is the department's intent that courses be uniform and meet all specification requirements. Visual inspection is the most important method of determining if the completed work meets the department's standards of quality. The minimum testing requirements of the acceptance program reflect actual values of small, specified areas. Therefore, it is always mandatory that a strong visual inspection program be established and maintained during the construction process to guarantee that these acceptance tests do in fact represent a uniform product. Prior to final acceptance, the inspector will visually inspect the entire section. If visual inspection shows that the course is not uniform or that the test values may not be representative of the entire section, corrections will be required. Deficiencies identified by visual inspection, such as laminations, dimensional deficiencies, soft areas, etc., shall be corrected before the section will be accepted. **When deficiencies are identified by visual inspection, the section will not be accepted until they have been corrected, regardless of the results of routine acceptance tests.**

### **Treated Layer Under Asphaltic Concrete**

Inspection and acceptance shall meet the requirements of Section 305

### **PROTECTION AND CURING**

**When traffic, including construction traffic, is allowed on the base course, and the surfacing is to be asphaltic concrete, at least the first lift of surfacing shall be placed within thirty days of the completion of the base course section.**

### **Soil Cement, Cement Stabilized Sand Clay Gravel, Cement Stabilized Sand-Shell, or Treated Layer Under Asphaltic Concrete.**

Immediately after finishing the base course, the contractor shall spray an asphalt curing membrane over the finished section in accordance with Specification Section 506. This membrane shall completely cover the finished base course. Complete coverage shall be maintained until the placement of the next course. Unless required by the department, no traffic, including construction traffic, shall be allowed on the base course for at least 72 hours after the application of the curing membrane. When traffic, including construction traffic, is allowed on the base course, at least the first lift of surfacing shall be placed within thirty days of the completion of the base course section.

### **Stone, Crushed Slag, or Recycled PCC**

Immediately after finishing the base course, the contractor shall spray a prime coat over the finished section in accordance with Specification Section 505. This prime coat shall completely cover the finished base course. Complete coverage shall be maintained until the placement of the next course. Unless required by the department, no traffic, including construction traffic, shall be allowed on the base course for at least 72 hours after the application of the prime coat. When traffic, including construction traffic, is allowed on the base course, at least the first lift of surfacing shall be placed within thirty days of the completion of the base course section.

### **MAINTENANCE OF THE BASE COURSE**

The contractor shall be responsible for the completed base course. It shall be protected from damage from public or construction traffic or construction operations. The contractor shall maintain the base course in the condition in which it was accepted until the next lift is placed. The contractor shall make any necessary repairs, including patching or reconstruction, and reapplication of the protective coating. For the first 72 hours after the completion of the base course, unless required by the department, no traffic, including construction traffic, shall be allowed on the base course. This period is designed to allow stabilized base course to develop adequate strength to support axle loads without structural damage and it allows the prime coat on raw base courses to cure without damage. All correction of deficiencies shall be completed at least 24 hours prior to the placement of the subsequent lift over the base course.

## **QUALITY ASSURANCE DOCUMENTATION**

Tests and inspections required by the specifications, this manual, or other department publications must be documented. QA documentation for asphaltic concrete or Portland cement concrete when used as a Class 1 base course must meet the requirements of the appropriate application manual for Sections 501, 502, or 901. The department provides standard forms for documentation that are to be used by both contractor and department personnel, as specified. These forms are required in addition to field book entries and the Project Diary required of DOTD construction personnel. Forms are to be properly completed and, when indicated, submitted with the Form 2059 - Summary of Test Results. QA documentation verifies that the project has been built in accordance

with the contract, plans and specifications. Copies of QC documentation shall be provided to the project engineer as directed.

## **CENTRAL MIX PLANT CERTIFICATION REPORT**

Plant certification is required when a central mix plant is used. District laboratory personnel will use the form, *Central Mix Plant Certification Report*, to document the certification inspection of central mix plants. The completed form is used for ninety-day review inspections or any intermediate inspections that may be required. Ninety-day review and intermediate inspections will be documented by date, remark and signature at the end of the form. The completed form will be kept on file at the district laboratory and a copy sent to the project engineer(s) receiving material from the plant, the DOTD Materials Engineer Administrator, and the contractor. Refer to Appendix page A-5 for a copy of the *Base Course Central Mix Plant Certification Report*. Notification of the certification of the plant will also be sent to the headquarters Construction Section.

## **SOILS/SOIL-AGGREGATE FORM AND AGGREGATE TEST REPORT**

As dedicated stockpiles are being built, the material will be sampled and tested by DOTD personnel. When there are specifications requirements for the individual materials, test results will be documented on the *Soils/Soil-Aggregate* form (DOTD Form No. 03-22-0723) or the *Aggregate Test Report* (DOTD Form No. 03-22-0745) in accordance with standard department procedures. Gradations for material composites will be documented on the *Aggregate Test Report*.

## **BASE COURSE DESIGN FOR CLASS 1 STABILIZED BASE COURSE**

### **CONTRACTOR'S PROPOSAL**

When materials are composited and mixed at a central mix plant, the contractor shall submit the *Base Course Design* proposal to the district laboratory engineer for approval. The contractor shall complete the information for the Header, Materials, and Gradation (if applicable). The department will design, provide, and enter the additive rate. This information is derived from the test results documented during the approval process for dedicated stockpiles, included composited materials, and other documents provided by the department. When two or more soils are being composited and mixed, each stockpile will require individual approval. Once the stockpiles are approved, the mix design may be submitted with the proposed percentages of each for composite. Soil cement design, the percent cement, optimum moisture, and maximum dry density will be determined on the proposed composite. Refer to the *MATT System Manual Field Handbook* for MATT Codes. Note that the date first used and the project number are to be left blank by the contractor.

### **DEPARTMENT APPROVAL**

The district laboratory will complete the *Base Course Design* form, recording the maximum dry density and optimum moisture content. A copy of the *Base Course Design* will be provided to the contractor and the project engineer. The *Base Course Design* is to be incorporated into the 2059 Review. If the design proposal is not approved, the district laboratory engineer is to sign the form, emphasize "not approved," enter the reason for disapproval in the remarks, and return the form to the contractor. **No mixture is to be delivered to the project until a mix design has been approved;** therefore, there will be no MATT entry of a disapproved mix design proposal.

## **DAILY CENTRAL MIX PLANT REPORT**

The *Daily Central Mix Plant Report* is provided for the contractor to document routine testing at the central mix plant. It serves as both a worksheet and final documentation of plant operations. Department personnel will use the plant report as a worksheet during testing. The contractor's *Daily Central Mix Plant Report* is to be kept on file at the plant and made available for review by DOTD personnel upon request. All *Daily Central Mix Plant Report* forms completed by DOTD personnel for the project shall be provided to the project engineer for inclusion with Form 2059.

## **GRADATION AND SOIL PROPERTIES**

If more than one material is used to create a composite for the soil or aggregate portion of the base, the contractor shall perform gradation testing to ensure that the materials in the stockpile match the gradations shown on the *Base Course Design* and, when mixed, create a material which meets specification requirements.

The contractor shall set the cold feed system from this data. The gradation of the material composited from the cold feed and sampled from the belt, shall meet the gradation requirements, when applicable. Sampling of aggregates shall be performed in accordance with DOTD S-101 at the minimum frequency stipulated in the *Materials Sampling Manual*.

When the soil component of the base course is a composite of more than one soil, the composite shall be checked to ensure that it uniformly meets the parameters shown on the *Base Course Design for Central Plant Materials Mixtures*. The contractor shall check for QC and the department for acceptance.

The data required by specifications shall be documented on the *Daily Central Mix Plant Report*. Gradation shall be checked at least twice per day. Refer to Appendix, page A-19.

## **PROPORTIONING OF COMPONENTS**

The cold bin feed percentages shall be checked against the percentages approved on the *Base Course Design* form. The actual bin percentages shall be reported on the *Daily Central Mix Plant Report*. Proportions of all components shall be checked each time cement content is checked. Proportions are to be checked in accordance with DOTD TR 436.

## **ADDITIVE CONTENT**

The actual percentage of cement being incorporated into the mixture shall be checked and compared to the approved percentage from the *Base Course Design*. Following the test, the actual percentage shall be recorded on the *Daily Central Mix Plant Report* for the initial truck. The percent cement shall be checked at the beginning of each day's operation and at least four more times each day by the contractor. Additionally, whenever the plant discontinues operations during a day, the percent cement shall be rechecked when operations are resumed. These checks shall be performed by the contractor for QC and by the department for acceptance at the minimum frequency stipulated in the *Materials Sampling Manual*.

QC results are to be entered only when a test is performed. When new QC tests are performed, they are to be documented on the form, indicating the test number, time, and load number of the material from which the test sample was taken. Test results are to be entered on the form on the next truckload after results are obtained. When there is no test data to be entered, the certified technician is to check the appropriate block regarding design criteria and sign the form. The signature indicates that there have been no changes in production since the last QC test.

## **MOISTURE CONTENT**

Prior to beginning daily operations, the contractor's certified inspector shall determine the moisture content of stockpile material. This moisture content shall be used to adjust the amount of water to be added to the mixture. Once operations have begun, the moisture content of the material from the pugmill discharge shall be checked to ensure that the moisture in the mix at the time of compaction will be within the specification range of  $\pm 2\%$ . Moisture content of the blend shall be checked at the beginning of each day's operation, when operations are resumed after a discontinuance, and at least two more times each day. This moisture content data is to be recorded on the *Daily Central Mix Plant Report*.

## **ACCEPTANCE TESTS**

Tests for percent cement, moisture content, and pulverization will be documented on the *Daily Central Mix Plant Report* by the DOTD inspector. The contractor's Certified Technician is to review the form and sign it to indicate that this review has taken place.

## **CERTIFICATE OF MATERIAL PROPORTIONS (HAUL TICKET)**

### **Central Mix Plant**

The *Certificate of Material Proportions for Base Course* is used by the contractor's certified technician to document testing at the plant. The form is to be completed by the contractor's certified technician for each truck and updated each time a QC test is performed. The contractor's certified technician shall summarize the results of the most recent tests from the *Daily Central Mix Plant Report* as required on the *Certificate of Material Proportions for Base Course*. The "Lot No." shown on the form refers to the "plant lot." The load numbers will be consecutive per plant lot. The department will control the assignment of lot numbers. The lot number will correlate to the lot number shown on the *Daily Central Mix Plant Report*. The original *Certificate of Material Proportions for Base Course* completed by the contractor's certified technician is to be given to the driver of each hauling unit. The driver is to give the completed form to the DOTD inspector at the job site. The contractor's technician is to keep at least one copy of each *Certificate of Material Proportions for Base Course* at the plant for the review of department personnel.

The inspector at the project site will use the *Certificate of Material Proportions for Base Course* to document the location of material on the project. The location of material to which a payment adjustment will apply must be identified to determine the final percent

pay for each section. The beginning and ending stations of each lot must be documented. The location of any material placed on the project that does not meet specification requirements is to be documented for later correction. Refer to page A-21 for a reprint of the *Certificate of Material Proportions for Base Course*.

## **DENSITY & MOISTURE CONTENT WORKSHEET**

The test procedure DOTD TR 401 - The Determination of In-Place Density, contains a worksheet to be used to facilitate the calculations associated with the determination of density, moisture, and pulverization. This worksheet is to be completed in conjunction with this procedure and used for these calculations. Department personnel will submit this form for acceptance testing regularly to the district laboratory for MATT system entry. The district laboratory will retain the original for inclusion in the 2059 Review. A copy of the documentation of QC tests and results shall be given to department personnel as noted on page 4. The percent pay for density will be completed for treated or stabilized base only.

## **PAYMENT**

For asphaltic concrete or Portland cement concrete, refer to Section 501, 502, or 901 and the applicable *Quality Assurance* manual.

For treated subgrade layer refer to Section 305.

## **ACCEPTANCE WITHOUT PAYMENT ADJUSTMENT**

Acceptance criteria other than payment adjustments apply to Class I Base Course. If the section does not meet specification requirements for depth, width, grade, cross slope, percent moisture at compaction, pulverization, or other deficiencies identified through visual inspection, the deficiency must be corrected by the contractor at no direct pay in accordance with Specification Section 301. Corrections must be completed, inspected and approved in accordance with the timetable established by the engineer prior to the final documented acceptance of the course.

## **ACCEPTANCE WITH PAYMENT ADJUSTMENT**

Stabilized base has payment adjustments attached for both percent cement and percent density per section. **These payment adjustments are cumulative for stabilized base.** Raw base has a payment adjustment attached for percent density per section. Payment for a section to which a payment adjustment is applicable for both parameters will be made at a combined adjustment in pay, as shown in the following example.

### **EXAMPLE OF CUMULATIVE PAYMENT ADJUSTMENT - PER SECTION**

Percent Pay - Density:            90%    (10% reduction in pay)

Percent Pay - Cement :           80%    (20% reduction in pay)

Cumulative Reduction in Pay:        30%

Therefore, payment for this section will be made at 70% ( $100\% - 30\% = 70\%$ ) of the contract unit price.

When a deficiency in cement content causes production to be discontinued partway through a section, the percent payment for the section will be adjusted to reflect the failing portion for cement rate, as shown in the following example. When the payment adjustment is for insufficient density, the adjustment shall be applied to the entire section.

### **EXAMPLE OF CUMULATIVE PAYMENT ADJUSTMENT - PARTIAL SECTION (ROADWAY) AFFECTED BY CEMENT**

Percent Pay - Density: 90% (10% reduction in pay for 1000')

Percent Pay - Cement : 80% - (20% reduction in pay - applies to 350 linear feet {7% reduction in pay for 1000'})

$$\frac{350}{1000} \times 20 = 7\% \text{ pay reduction for 1000'}$$

Cumulative Reduction in Pay: 17%

10% (density reduction) + 7% (cement reduction for section) = 17% total reduction for section

Therefore, payment for this 1000-linear foot section will be made at 83% (100% - 17% = 83%) of the contract unit price.

## **REMOVAL AND REPLACEMENT OF STABILIZED BASE**

Any failing section will require documentation and a plan change for acceptance below the 100% payment level. The documentation will consist of the project engineer's statement of disposition of failing material to be incorporated in the 2059 Review.

When the payment adjustment for either density or cement is in the 50% or remove category, the department will investigate and may require that the material be removed and replaced. When removal is caused by failing density, the material shall be removed for the full width of the roadway for the entire length of the section. When removal is caused by failing cement, the material shall be removed for the full width of the roadway for the entire length of the plant lot placed in the section.

When the cumulative payment adjustment is less than 50%, the entire section shall be removed and replaced with central mix processed material.